

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

(a) forming a groove for wiring in a first insulating film formed on a semiconductor substrate;

(b) successively forming a barrier layer and a conductive film over said first insulating film including the inside of said groove for wiring and removing said barrier layer and said conductive film from outside of said groove for wiring by polishing, thereby forming a wiring;

(c) cleaning a surface of said first insulating film to remove conductive film that remains on said first insulating film in said step (b), and to improve plating selectivity and ability for preferential growth;

(d) forming a cap conductive film on said wiring by selective growth or preferential growth of said cap conductive film on said wiring;

(e) cleaning a surface of said first insulating film after said step (d) to remove undesired cap conductive film grown on the surface of said first insulating film; and

(f) forming a second insulating film over said cap conductive film and said first insulating film.

2. (Currently Amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

(a) forming a groove for wiring in a first insulating film formed on a semiconductor substrate;

(b) successively forming a barrier layer and a conductive film over said first insulating film including the inside of said groove for wiring and removing said barrier layer and said conductive film from outside of said groove for wiring by polishing, thereby forming a wiring;

(c) cleaning a surface of said first insulating film to remove conductive film that remains on said first insulating film in said step (b), and to improve plating selectivity and ability for preferential growth;

(d) forming a cap conductive film on said wiring in self-alignment with said wiring by selective growth or preferential growth of said cap conductive film on said wiring;

(e) cleaning a surface of said first insulating film after said step (d) to remove undesired cap conductive film grown on the surface of said first insulating film;

(f) forming a second insulating film over said cap conductive film and said first insulating film;

(g) partly removing said second insulating film on said wiring to form an opening so that said cap conductive film is exposed; and

(h) forming a second conductive film in said opening.

3. (Currently Amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

(a) forming a first wiring on a semiconductor substrate;

- (b) forming a first insulating film on said first wiring;
- (c) removing said first insulating film at a portion thereof corresponding to a contact region of said first wiring to form a contact hole;
- (d) forming a first conductive film over said first insulating film including the inside of said contact hole;
- (e) removing said first conductive film from outside of said contact hole to form a plug;
- (f) forming a second insulating film over said first insulating film and said plug;
- (g) removing said second insulating film at a portion thereof corresponding to a region where a second wiring is to be formed, thereby forming a groove for wiring;
- (h) successively forming a barrier layer and a second conductive film on said second insulating film including the inside of the said groove for wiring;
- (i) removing said barrier layer and said second conductive film from outside of said groove for wiring by polishing to form a second wiring;
- (j) cleaning a surface of said second insulating film to remove said second conductive film that remains on said second insulating film in said step (i), and to improve plating selectivity and ability for preferential growth;
- (k) forming a cap conductive film on said second wiring in self-alignment with said second wiring by selective growth or preferential growth of said cap conductive film on said second wiring;
- (l) cleaning a surface of said second insulating film after said step (k) to remove undesired cap conductive film grown on the surface of said second insulating film; and
- (m) forming a third insulating film over said cap conductive film and said

second insulating film.

4. (Currently Amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

- (a) forming a first wiring on a semiconductor substrate;
- (b) successively forming a first insulating film and a second insulating film on said first wiring;
- (c) removing said first insulating film and said second insulating film at a portion thereof corresponding to a contact region of said first wiring to form a contact hole;
- (d) removing said second insulating film at a portion thereof corresponding to a region where a second wiring is to be formed thereby forming a groove for wiring;
- (e) successively forming a barrier layer and a conductive film on said second insulating film including said contact hole and the inside of the said groove for wiring;
- (f) removing said barrier layer and said conductive film from outside of said contact hole and said groove for wiring by polishing to form a second wiring and a connection between said first wiring and said second wiring;
- (g) cleaning a surface of said second insulating film to remove said second conductive film that remains on said second insulating film in said step (f), and to improve plating selectivity and ability for preferential growth;
- (h) forming a cap conductive film on said second wiring in self-alignment with said second wiring by selective growth or preferential growth of said cap conductive film on said second wiring;

(i) cleaning a surface of said second insulating film after said step (h) to remove undesired cap conductive film grown on the surface of said second insulating film; and

(j) forming a third insulating film over said cap conductive film and said second insulating film.

5. (Currently Amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

(a) forming a first wiring on a semiconductor substrate;

(b) successively forming a first insulating film and a second insulating film on said first wiring;

(c) removing said second insulating film at a portion thereof corresponding to a region where a second wiring is to be formed to form a groove for wiring;

(d) removing said first insulating film at a portion thereof corresponding to a contact region of said first wiring thereby forming a contact hole;

(e) successively forming a barrier layer and a conductive film on said second insulating film including said contact hole and the inside of the said groove for wiring;

(f) removing said barrier layer and said conductive film from outside of said contact hole and said groove for wiring by polishing to form a second wiring and a connection between said first wiring and said second wiring;

(g) cleaning a surface of said second insulating film to remove said second conductive film that remains on said second insulating film in said step (f), and to improve plating selectivity and ability for preferential growth;

(h) forming a cap conductive film on said second wiring in said self-

alignment with said second wiring by selective growth or preferential growth of said cap conductive film on said second wiring;

(i) cleaning a surface of said second insulating film after said step (h) to remove undesired cap conductive film grown on the surface of said second insulating film; and

(j) forming a third insulating film over said cap conductive film and said second insulating film.

6. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to Claim 4 or 5 further comprising the steps of:

partly removing said third insulating film to form an opening so that said cap conductive film is exposed;

burying a conductive material in said opening to form a plug; and

forming an upper wiring, which extends on said plug, on said third insulating film.

7. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to Claim 3, 4 or 5, wherein said second wiring is made of copper, silver, aluminum or an alloy containing these metals as a main component.

8. (Original) A method for manufacturing a semiconductor integrated circuit device according to Claim 1, wherein said cap conductive film is a film made of W.

9. (Original) A method for manufacturing a semiconductor integrated circuit device according to Claim 1, wherein said cap conductive film is a film made of WN, TiN, Ta, TaN or Ni.

10. (Original) A method for manufacturing a semiconductor integrated circuit device according to Claim 1, wherein said cap conductive film is formed at a pressure of 1 Torr ($1 \times 1.33322 \times 10^2$ Pa) or below.

11. (Original) A method for manufacturing a semiconductor integrated circuit device according to Claim 1, wherein said second insulating film is formed by the steps of:

(a) forming a TEOS film or a carbon-containing silicon-based insulating film on said cap conductive film; and

(b) forming, on said TEOS film or said carbon-containing silicon-based insulating film, a film whose dielectric constant is lower than that of said TEOS film or said carbon-containing silicon-based insulating film.

12. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to Claim 1, wherein said second insulating film is formed by the steps of:

(a) forming, on said cap conductive film, a diffusion-preventing insulating film for preventing the diffusion of a conductor material constituting said cap conductive film; and

(b) forming, on said diffusion-preventing insulating film, a low dielectric insulating film whose dielectric constant is lower than said diffusion-preventing insulating film.

13. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to Claim 12, wherein said diffusion-preventing insulating film is made of a silicon nitride film, a PSG film, or a carbon-containing silicon-based insulating film including a silicon carbide (SiC) film or a SiCO film.

14. (Original) A method for manufacturing a semiconductor integrated circuit device according to Claim 12, wherein said low dielectric insulating film includes at least one of a TEOS film, a fluorine-containing silicon oxide film such as SiOF film, a carbon-containing silicon-based insulating film such as SiOC, an organic insulating film and a porous silica film.

15. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to Claim 1, wherein said cleaning in said step (c) is performed by using a solution containing at least one of hydrogen fluoride (HF), citric acid, oxalic acid, hydrogen peroxide (H₂O₂), hydrochloric acid (HCl), sulfuric acid (H₄SO₄), ammonia (NH₃) and aminoethanol.

16. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to Claim 1, wherein said step (c) includes a sub-step of treating substrate surfaces with hydrogen.

17. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to Claim 1, wherein said step (e) is performed by using a solution containing at least one of hydrogen fluoride (HF), hydrogen peroxide (H₂O₂) and citric acid after the selective growth or preferential growth of said cap conductive film.

Claims 18-36. (Canceled)

37. (Original) A method for manufacturing a semiconductor integrated circuit device according to Claim 1, wherein said cap conductive film is selectively formed on said wiring by a selective CVD (chemical vapor deposition) method, and said conductive film is constituted of a copper film.

Claim 38. (Canceled)

39. (Currently Amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

(a) forming a groove in a first insulating film formed on a semiconductor substrate;

(b) depositing a first conductive film comprising copper as a main component thereof on said first insulating film including the groove;

(c) removing said first conductive film from outside of said groove by polishing to bury said first conductive film in said groove;

(d) cleaning with a solution capable of removing a foreign matter or a contaminant metal from a surface of said first insulating film to remove said contaminant metal that remains on a surface of said first insulating film in said step (c), and to improve plating selectivity and ability for preferential growth;

(e) forming a cap conductive film on said first conductive film in said groove in self-alignment with said first conductive film by selective growth of the cap conductive film on said first conductive film buried in said groove by a selective CVD (chemical vapor deposition) method; and

(f) cleaning a surface of said first insulating film with a solution capable of

removing a foreign matter or a contaminant metal after said step (e) to remove undesired cap conductive film grown on the surface of said first insulating film.

Claim 40. (Canceled)

41. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to Claim 39, wherein said cleaning in said step (d) is a cleaning with a solution containing at least one of hydrogen fluoride (HF), citric acid, oxalic acid, hydrogen peroxide (H₂O₂), hydrochloric acid (HCl), sulfuric acid, ammonia (NH₃) and aminoethanol.

42. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to Claim 39, wherein said cap conductive film is made of a tungsten film.

43. (Currently Amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

- (a) forming a groove in a first insulating film formed on a semiconductor substrate;
- (b) depositing a copper film on said first insulating film including the groove;
- (c) removing said copper film from outside of said groove to bury said copper film in said groove;
- (d) cleaning with a solution capable of removing a foreign matter or a contaminant metal from a surface of said first insulating film to remove said

contaminant metal that remains on a surface of said first insulating film after said step (c), and to improve plating selectivity and ability for preferential growth;

(e) forming a cap conductive film on said copper film in said groove by selective growth of the cap conductive film on said copper film buried in said groove; and

(f) cleaning the resultant semiconductor substrate with a solution capable of removing a foreign matter or a contaminant metal to remove undesired cap conductive film grown on the surface of said first insulating film.

44. (Original) A method for manufacturing a semiconductor integrated circuit device according to Claim 43, further comprising, after the step of (d), treating said copper film with hydrogen.

45. (Original) A method for manufacturing a semiconductor integrated circuit device according to Claim 44, further comprising, between the steps of (b) and (c), treating said copper film with hydrogen.

Claim 46. (Canceled)

47. (Currently Amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

(a) forming a groove in a first insulating film formed on a semiconductor substrate;

(b) depositing a copper film on said first insulating film including the groove;

- (c) removing said copper film from outside of said groove to bury said copper film in said groove;
- (d) treating said copper film with hydrogen;
- (e) cleaning with a solution capable of removing a foreign matter or a contaminant metal from a surface of said first insulating film to remove said contaminant metal that remains on a surface of said first insulating film, and to improve plating selectivity and ability for preferential growth;
- (f) forming a cap conductive film on said copper film in said groove by selective growth of the cap conductive film on said copper film buried in said groove;
- (g) cleaning the resultant semiconductor substrate with a solution capable of removing a foreign matter or a contaminant metal to remove undesired cap conductive film grown on the surface of said first insulating film; and
- (h) treating the copper film, buried in said groove, with ammonia (NH₃).

Claim 48. (Canceled)

49. (Currently Amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

- (a) forming a groove in a first insulating film formed on a semiconductor substrate;
- (b) depositing a copper film on said first insulating film including the groove;
- (c) removing said copper film from outside of said groove to bury said copper film in said groove;

(d) after the step of (c) , cleaning with a solution capable of removing a foreign matter or a contaminant metal, and to improve plating selectivity and ability for preferential growth;

(e) after the step of (c) , treating said copper film with hydrogen;

(f) forming a cap conductive film on said copper film in said groove by selective growth of the cap conductive film on said copper film buried in said groove;
and

(g) cleaning the resultant semiconductor substrate with a solution capable of removing a foreign matter or a contaminant metal to remove undesired cap conductive film grown on the surface of said first insulating film.

50. (Original) A method for manufacturing a semiconductor integrated circuit device according to Claim 49, wherein the step of (e) is carried out after the step of (d).

51. (Previously Presented) A method for manufacturing semiconductor integrated circuit device according to claim 4, said cleaning in said step (g) is performed by using a solution containing at least one of hydrogen fluoride (HF), citric acid, oxalic acid, hydrogen peroxide (H₂O₂), hydrochloric acid (HCl), sulfuric acid (H₄SO₄), ammonia (NH₃) and aminoethanol.

52. (Previously Presented) A method for manufacturing semiconductor integrated circuit device according to claim 5, said cleaning in said step (g) is performed by using a solution containing at least one of hydrogen fluoride (HF), citric acid, oxalic acid, hydrogen peroxide (H₂O₂), hydrochloric acid (HCl), sulfuric acid (H₄SO₄), ammonia (NH₃) and aminoethanol.

53. (Previously Presented) A method for manufacturing semiconductor integrated circuit device according to claim 4, wherein said step (i) is performed by using a solution containing hydrogen fluoride (HF), hydrogen peroxide (H₂O₂), or a solution capable of removing foreign matters or a contaminant metal after the selective growth or preferential growth.

54. (Previously Presented) A method for manufacturing semiconductor integrated circuit device according to claim 5, wherein said step (i) is performed by using a solution containing hydrogen fluoride (HF), hydrogen peroxide (H₂O₂), or a solution capable of removing foreign matters or a contaminant metal after the selective growth or preferential growth.

55. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to claim 1, further comprising the steps of:

- (a) partly removing said second insulating film to form an opening so that said cap conductive film is exposed;
- (b) burying a conductive material in said opening to form a plug; and
- (c) forming an upper wiring, which extends on said plug, on said second insulating film.

56. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to claim 1, wherein said wiring is made of copper, silver, aluminum or an alloy containing these metals as a main component.

57. (Previously Presented) A method for manufacturing a semiconductor integrated circuit device according to claim 2, wherein said wiring is made of copper, silver, aluminum or an alloy containing these metals as a main component.

58. (Currently Amended) A method for manufacturing a semiconductor integrated circuit device, comprising the steps of:

- (a) forming a groove in a first insulating film formed on a semiconductor substrate;
- (b) depositing a copper film on said first insulating film including the groove;
- (c) removing said copper film from outside of said groove to bury said copper film in said groove;
- (d) cleaning with a solution capable of removing a foreign matter or a contaminant metal from a surface of said first insulating film to remove said contaminant metal that remains on a surface of said first insulating film, the solution containing at least one of hydrogen fluoride (HF), citric acid, oxalic acid, hydrogen peroxide (H₂O₂), hydrochloric acid (HCl), sulfuric acid (H₄SO₄) and ammonia (NH₃);
- (e) forming a cap conductive film on said copper film in said groove by selective growth of the cap conductive film on said copper film buried in said groove; and
- (f) cleaning the resultant semiconductor substrate with a solution capable of removing foreign matter or a contaminant metal to remove undesired cap conductive film grown on the surface of said first insulating film, that solution containing hydrogen fluoride (HF), hydrogen peroxide (H₂O₂), or a solution capable of removing foreign matters or a contaminant metal after the selective growth or preferential growth.